PATENT SPECIFICATION

1,126,586

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Liquid Discharge Device for Gas-Liquid Contacting Trays

We, SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N.V. a Company organised under the Laws of the Netherlands, of 30, Carel van Bylandtlaan, The Hague, the Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a tray for contacting liquids and gases that is provided with one or more discharge devices for liquid, which devices discharge into the space under the tray, and where means are present for the prevention of gas flow through those discharge devices.

These trays can be used in columns for the distillation of hydrocarbons. The term gas is taken throughout this specification also to include vapour.

Contacting trays where gas flow through the liquid discharge device is prevented are known. For example under such a discharge device an appliance may be provided for receiving the liquid discharged. This receiving appliance is provided with a weir which is at least as high as the underside of the discharge device. The space in the discharge device is then always separated from the space under the tray by the liquid present in the receiving appliance. In this construction however the receiving appliance may form an obstacle in the space under the tray which then reduces the capacity.

The discharge openings of the liquid discharge device also may be provided with hinged non-return valves which are opened by the liquid flowing down. As the valves are opened only so far as is necessary for permitting the passage of the liquid, it is impossible for gas to flow upwards. This solution, however, has the disadvantage that the free movement of the valves may be hindered, for instance by deposition of dirt or as a result of corrosion, in consequence of which the intended action is nullified, while it is even possible that the discharge of liquid is hindered.

The invention now provides the means by which the flow of gas through the liquid discharge device is substantially or completely prevented without the use of any moving parts, while these means do not perceptibly impede the flow of liquid and gas.

According to the invention a tray for contacting liquids and gases has at least one discharge device provided with a discharge opening whereby liquid may discharge from the tray into the space under the tray, means being provided for the prevention of gas flow through the discharge device, the said means consisting of at least one member by which at least a part of the liquid is discharged in such a way that, near the discharge opening, it forms a liquid screen which, together with a plate located under the discharge opening, forms a gas flow barrier.

By this liquid screen the space within the liquid discharge device is separated from the gas space under the tray. Therefore the gas will at all loads flow entirely through the tray and take part in the process of contacting the liquid.

For the barrier it is sufficient if the width of the plate is equal to that of the discharge opening and if the screen liquid flows along the edge of the plate or at a small distance from it. If the plate is wider and is struck by the liquid, the edge of the plate may be turned downwards, by which it is ensured that the screen liquid changes its direction to a lesser extent.

The discharge device may have an enclosing wall projecting above and below the tray, a second wall being present around the entire circumference or only over part of the circumference of the enclosing wall, the said second wall, together with that part of the said enclosing wall which is located below the tray, forming a chamber arranged at its upper end to

[*Price 4s. 6d.*]

receive liquid from the tray and which chamber at its lower end terminates in a slot positioned near to or forming part of the discharge opening.

This embodiment has the advantage that all parts or walls intended for guiding the screen liquid and for the formation of the screen may be integrated with the liquid discharge device, as a result of which a simple construction is obtained that can be easily mounted on the tray. In addition it is ensured that at low loads, where a liquid layer of only a small thickness is present on the tray, a relatively large proportion of the tray liquid is directed to the screen, so that in that case also the formation of a continuous screen becomes possible.

In determining the width of the upper part of the chamber formed by the two walls, the nature of the liquid supplied to that chamber should, in a manner which in itself is known, be taken into consideration. Thus, if that liquid contains a large proportion of gas, the width will have to be relatively large to make it possible for the gas to escape upwards. This will be the case, for instance, when the discharge device has no or only a low weir, in which case a liquid-gas mixture containing a large proportion of gas is supplied to the chamber. If, on the other hand, the weir is relatively high and the chamber is near that weir in contact with the tray liquid, then an important part of the liquid supplied to that chamber will be liquid that has coalesced against the weir. As this liquid contains only a small proportion of gas, in this case the width at the upper side can be selected to be smaller.

It is alternatively possible for the discharge device to have a wall projecting above and below the tray a part of the wall above the tray having one or more openings therein to permit liquid to pass from the tray through the wall and down the side thereof and thence into a space formed between the wall and a further wall situated below the tray and spaced from the first wall, the said space terminating at its lower end in a slot positioned near to or forming part of the discharge opening.

With this embodiment, where all the parts intended for guiding the screen liquid may likewise be integrated with the discharge device, the outside dimensions of the discharge device may be equal to those of a corresponding discharge device without the provision of a liquid screen, which may be an advantage when on existing trays liquid discharge devices are replaced by discharge devices according to the invention.

By having the second wall extend over only a part of the wall of the discharge device, a saving in material is obtained while, in addition, the discharge device over part of its height is free from obstacles, which promotes the escape of gases from the liquid and reduces the resistance encountered by the flow of liquid.

If the liquid supply openings are provided close to the upper tray surface, then with this embodiment also sufficient screen liquid becomes available even at low loads. In determining the area of the supply openings the nature of the liquid supply should again be taken into consideration.

The plate located under the discharge opening may be formed by a part of a lower tray which part is not provided with gas passages. This results in a simple construction.

The thickness of the liquid screen preferably amounts to from 1 to 3 mm. The stability of a screen of this thickness is generally sufficient to prevent flow of gas through the liquid discharge device. For a screen of this thickness sufficient liquid is available even at low loads.

The invention may be carried into practice in various ways but three specific embodiments will now be described by way of example with reference to the accompanying drawings, in which;

Figure 1 includes a top view and a side sectional elevation of part of a tray according to the invention;

Figure 2 shows both a sectional side elevation of part of a tray forming another embodiment of the invention together with a sectional end elevation on the line A—A; and

Figure 3 is a side sectional elevation of part of a tray forming a third embodiment wherein the plate under the discharge opening is formed by a part of a lower tray.

In the embodiment of Figure 1 a tray 1 is provided with gas passages 2, the tray being of generally circular form as indicated in the lower half of Figure 1 and being provided along one segment thereof with a liquid discharge device 3. This discharge device is bounded by a part of the column wall 4 and by a wall 5 extending in a straight line between two points in the circumference of the column wall 4 thereby providing a discharge passage for liquid between it and the wall 4 into which liquid can flow by overflowing a part 5^1 of the wall 5 which is located above the surfaces of the tray 1 and which thereby forms a weir between the discharge device and the exchange section of the tray. Running substantially parallel to the lower part of the wall 5 is a second wall 6 which is situated on the side of the wall 5 but is spaced therefrom to provide a slot shaped opening 8 at its upper end a slot shaped opening 9 at its lower end. As shown in the upper half of Figure 1 the wall 6 depends from the tray 1. Extending inwards from the column wall 4 below the slot shaped opening 9 is a horizontal plate 11 which forms between it and the lower edge of the wall 5 the discharge opening 10 of the discharge device 3.

In the second embodiment illustrated in Figure 2 the tray 1 is again provided with a discharge device which in this instance is

of box-like construction having side walls shown in the lower half of Figure 2, and end walls shown in the upper half of Figure 2. both end walls and side walls taper as shown and as illustrated in the upper half of Figure 2 extending between the end walls is a bottom wall or plate 11. The side walls as indicated in the lower half of Figure 2 terminate short of the plate 11 to provide discharge openings 10 on each side of the device. The upper ends of the side and end walls of the device extend above the surface of the tray 1 as in the first embodiment to provide a weir 5'.

Extending the length of each side wall adjacent the level of the tray surface is a slit-like opening 13 whereby a certain amount of liquid from the surface of the tray can flow directly through the openings 13 and down the inside surfaces of the side walls.

Situated within the device is a further box like structure 12 having tapered end walls by which the structure 12 is secured to the end walls of the discharge device and side walls which are parallel to one another and extend vertically but which are spaced from the side walls of the discharge device as shown in the lower half of Figure 2 thereby to provide on each side a narrow slightly tapering passage 15 which terminates at its lower end in a slot shaped opening 9 just above the discharge openings 10.

In the third embodiment shown in Figure 3 a column 4 is again provided with a tray 1 provided with a discharge device generally indicated at 3 and comprising a vertical wall 5 secured to the tray 1 and having a weir portion 5' which is provided adjacent the tray surface with a liquid supply opening 13. The wall 5, being spaced from the column wall 4, provides the discharge passage for liquid overflowing the weir 5' but situated within this passage are two further elements one of which is indicated at 14 which overlies the opening 13 and the other of which forms a vertical wall 12 situated adjacent the lower end of the wall 5. The elements 12 and 14 ensure that liquid passing through the opening 13 flows along the wall 5 to the space between the walls 5 and 12 and thereafter flows downwards to provide, with the next lower tray 1' an arrangement according to the invention. The part of the tray 1' situated between the wall 5 and the column wall 4 is not perforated.

The gas passages shown in the trays in the various embodiments are shown as circular openings. These openings may be provided with valves, caps or other devices known for trays of this kind. It is also possible to use grid trays.

WHAT WE CLAIM IS:—

1. A tray for contacting liquids and gases having at least one discharge device provided with a discharge opening whereby liquid may discharge from the tray into the space under the tray, means being provided for the prevention of gas flow through the discharge device, the said means consisting of at least one member by which at least a part of the liquid is discharged in such a way that, near the discharge opening, it forms a liquid screen which, together with a plate located under the discharge opening, forms a gas flow barrier.

2. A tray as claimed in Claim 1 in which the discharge device has a wall projecting above and below the tray, a second wall being provided which extends below the tray and is spaced from the said first wall to form a space between the walls opening at the tray surface to receive liquid therefrom and the space terminating at its lower end in a slot positioned near to or forming part of the discharge opening.

3. A tray as claimed in Claim 1, in which the discharge device has an enclosing wall projecting above and below the tray, and in which a second wall is present around the entire circumference or only over part of the circumference of the enclosing wall, the said second wall, together with that part of the said enclosing wall which is located below the tray, forming a chamber arranged at its upper end to receive liquid from the tray and which chamber at its lower end terminates in a slot positioned near to or forming part of the discharge opening.

4. A tray as claimed in Claim 1 in which the discharge device has a wall projecting above and below the tray, a part of the wall above the tray having one or more openings therein to permit liquid to pass from the tray through the wall and down the side thereof and thence into a space formed between the wall and a further wall situated below the tray and spaced from the first wall, the said space terminating at its lower end in a slot positioned near to or forming part of the discharge opening.

5. A tray as claimed in any one of the preceding claims, in which the plate located under the discharge opening is formed by a part of a lower tray which part is not provided with gas passages.

6. A tray as claimed in any one of the preceding claims, in which the liquid screen has a thickness of from 1 to 3 mm.

7. A tray for contacting liquids and gases substantially as described herein with reference to any one of the Figures of the accompanying drawings.

8. A column provided with two or more trays according to any one of the preceding claims.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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1126586 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

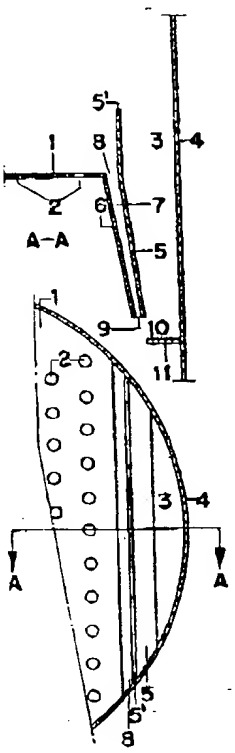

FIG. 1

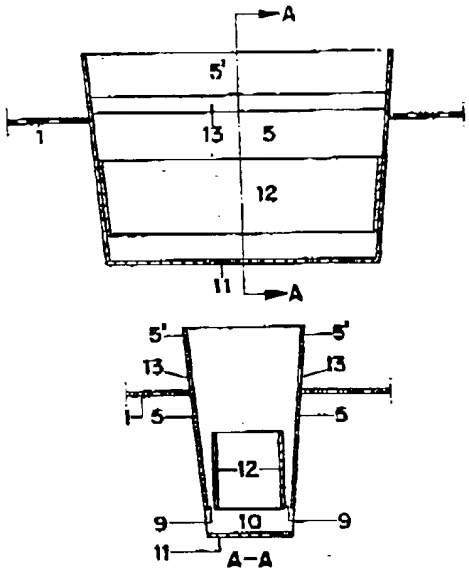

FIG. 2

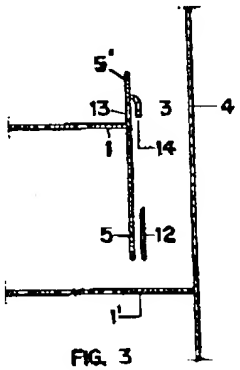

FIG. 3